105

DATA PROCESSING DIGEST

A SERVICE OF CANNING SISSON AND ASSOCIATES

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General Information

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"The controller's part in automation," *by T. F. Bradshaw, Cresap, McCormick & Paget, New York.*

AUTOMATION, August 1955; pages 105, 106.

Decentralized management and divisional controllership

"A large revolution in concepts of management is now underway...." Added to it is "the mechanical revolution in data processing." Mr. Bradshaw believes that "proper use of these tools will...provide the means of making decentralized management effective." With decentralized management will come divisional controllership, and the separation of data processing from data analysis functions. The organization of these two functions will probably take this form: "At the top level of management, a data processing center into which is fed original data and from which is obtained reports and documents for all levels of management, plus an analytical group...to help management plan and control operations by devising control systems, analyzing results and translating business problems into computer language.

"At the divisional level of management, an office manager whose function it is to prepare original data for transmittal to the data processing center, plus an analytical group...to analyze and interpret reports prepared by the data processing center and to insure that the informational needs of the division are being met."

(From an address delivered at the Midwestern Regional Conference of the Controllers Institute of America, June 1955.)

"Automation brings social changes," *by J. B. Shallenberger, Stanford Research Institute, Stanford, California.*

AUTOMATION, August 1955; pages 106, 107.

New patterns in living, leisure, jobs, education

"Automation will in some respects reconstitute our worker, changing both his functions, his qualifications, and his mode of life. It will demand

of him some fortunate yet troublesome social readjustments."

Increased leisure--If idleness creates problems, we must know what to do about them.

Upgrading of skills and virtual reconstitution of the work force--Who will educate these people? How will they adapt to new levels of responsibility?

Reduced demand for the unskilled and untrainable--What can we do with the unskilled workers...with workers who are too old to learn and adapt?

Dispersion of industrial plants--new automatized factories will be less dependent on large pools of labor and thus less oriented toward heavily populated areas.

Upgrading of communities--increasing proportion of skilled middle class residents and dispersion of industry will increase the attractiveness of communities and shift demands for types of recreation and community facilities. High price of services--Will society understand why lawyers, teachers, engineers, reporters, salesmen, cooks, hairdressers, etc. want higher pay to keep pace with factory and office workers?

Reduced employee density within factories--some industries will be characterized by widely scattered hermit employees.

Rising standard of living and material abundance--there will be a need for deeper understanding of our goals; and a danger of deepening problems abroad, if through automation "we open the gap between ourselves and the have-nots."

"Automation will bring more material good fortune to lives everywhere... It will also bring a growing need for the thinking and inspiration of...social workers...of a search for true values and deep spiritual understanding--so that society may be truly blessed and not burdened with its newfound material resource."

(From a talk presented at the National Conference of Social Work, June 1955.)

"Workshop for Management," ***Proceedings of the Systems and Procedures Association Published by MANAGEMENT MAGAZINES, Inc., 1955.***

Complete proceedings published

The volume includes the papers, panels and seminars which made up the Seventh Annual Systems Meeting of the Systems and Procedures Association in New York, October 1954. The papers include operations research, work simplification, practical problems of office management control, and introductory remarks on recent important innovations in management techniques, influenced and implemented by the use of electronics.

The latter half of the volume investigates the whole area of planning for and installing electronic data processing systems. It includes papers on techniques and equipment of the "automatic office," and business electronics in general. Several papers present descriptions of electronic equipment now available.

(See DPD, this issue, pages 3, 4, 6, 10.)

"Preparing for electronic data-processing," *by E. G. Benser, C.I.T. Financial Corp.*

PROCEEDINGS, Systems and Procedures Association, 1955*

Making a study of data processing needs

The paper is a description of the program being pursued by C.I.T. Financial Corp. toward conversion to an electronic data processing system. The program covers:

"1. The selection of potential areas for problem and machine study.
2. The organization of a special methods staff.
3. Review and modernization of existing methods.
4. A method of improving input through utilization of common-language equipment.
5. A specific application in process involving the planned use of electronic data-processing systems in the area of human decision."

At the moment they are concerned with "those areas which represent the greatest volume of unit transactions...." The investigation portion of the program is being carried on under these principles:

"1. A broad program clearly defined and recognized by top management.
2. A specialized staff organized to deal with this program at top management level and free to carry out these broad responsibilities without disturbing or interfering in any way with the day to day work improvement programs already in effect.

The first step was to organize the special methods group, to consist of representatives from tabulating, accounting, industrial engineering, electronic programming, and knowledge of company routines.

Current methods were reviewed and modernized as much as possible. Procedures were examined and "formalized." Problem areas which offered possibilities for immediate improvement and cost reduction were then selected.

In summary, the company's concept of a program for the installation of an electronic data processing system included:

"1. Management recognition of the vast potential for reducing costs and increasing efficiency through utilization of modern electronic equipment.

2. The willingness of management to spend money, that is, to conduct a research program which will relate this newly developed equipment to the particular needs of their own organization.
3. Providing for the establishing of a group of specialists who can apply creative thought in developing new solutions for old problems.
4. Require this group to take the following basic preparatory steps:
   a) Problem study
   b) Machine study
   c) Preliminary flow charts
   d) Cost analysis
   e) Final machine study
   f) Programming
   g) Test installation
5. Demonstration and review by a top management level committee for final determination as to complete installation.

* *See DPD this issue, page 2.*

"Applying electronic machines to an inventory problem--a case history,"
by Col. G. C. McDowell, U.S.A.F.

PROCEEDINGS, Systems and Procedures Association, 1955.*

Air Force inventory control study

The Air Force has been investigating, since 1948, the possible use of electronic equipment in its vast inventory control problem. Now, says Col. McDowell, "we seek to have in being at the end of 1958 a completely integrated world-wide electronic data processing system that starts right down at the using unit level. At this level, the unit supply sergeant... makes known his need for an item...by operating a simple keyboard or plate reading device which injects his demand directly into the integrated system. From this point on, transcription is accomplished through impulses and punched holes, without the need for clerks.

"The first destination of this electronic message is a base-level data processing machine which maintains balances and warehouse locations, and automatically retransmits to the appropriate warehouses where adequate stocks are indicated. If the quantity needed is not available at the local base, the need is electronically processed through commodity control centers possessing large capacity electronic equipment to depths where shipping orders are automatically prepared at the proper wholesale warehouses.

"In addition to processing orders from the field, the commodity control centers will electronically compute repair schedules, procurement requirements, and budget estimates; automatically redistribute stocks, evaluate planning and operating factors, prepare and simultaneously distribute catalogs, and perform many other essential functions."

Rand Corporation is assisting the Air Force in the design of the system, and within the Air Force personnel are beginning a 12 to 18 month initial experimental program, using various sizes of computers in parallel

with present systems at certain depots and bases. This program has these objectives:

"1. To develop techniques in the use of this new high speed equipment.
2. To enlist manufacturers' interest in our problems and to evaluate various engineering approaches.
3. To indoctrinate and train the thousands of people who must become familiar with this equipment and its capabilities."

The Air Force has learned that

"1. Faster progress will be made by indoctrinating in equipment capabilities those people who already know inventory control, rather than vice-versa.
2. There can be no electronic application in an allocation problem if the whole range of criteria needed to make a decision cannot be listed.
3. Electronic equipment is of value in direct proportion to the balance in ancillary equipment, and to communication speed in and out of the four-walled room.
4. Electronic data processing will force continued re-examination of organizational charts and functional alignments."

* See *DPD this issue, page 2*.

"Data Processing by Electronics," *by Haskins & Sells, Certified Public Accountants*

Book, Haskins & Sells, 1955

Basic text on data processing

As the Foreword in this well-written small book explains, "This study is not a technical treatise upon data processing by electronics. It seeks only to portray broadly the nature and implications of the new techniques available in the electronic system and the task to be met in learning to use them effectively." This aim, the Haskins & Sells organization has achieved with excellence.

The book begins with the basic functions of record-keeping as required by business, and progresses through increasingly automatic methods to the electronic data processing system. The fundamentals of programming and the basic concepts of electronic computing are described in detail, using a clerk-and-written-instruction analogy to explain the computer instructions and decision characteristics. The electronic representation of information and various forms of memory storage are covered in simple but effective descriptions.

An illustrative programming of a part of a payroll problem begins with the setting up of a flow chart, then goes into coding the problem for the computer; and finally into an accounting application of a company payroll using the entire electronic data processing system.

An appendix summarizes the characteristics and financial considerations of thirteen medium and large size electronic data processing systems.

"Initiating an electronics program," a Panel.

PROCEEDINGS, Systems and Procedures Association, 1955.*

A plan for surveying data processing requirements

The Panel consisted of Theron Aiken and L. C. Simmons of U.S. Steel, Thomas G. Rizzo of Bendix Aviation, J. H. McCall of The Port of New York Authority, and Robert Busch, Management Consultant.

Suggestions are given for making an initial study to obtain "sufficient facts to...make a comparison of present methods versus a computer application." It was considered advisable to keep top management informed of the progress of the study by supplying them with available publications, "the type...we thought were easy to read and would excite their interest in this program." The effect of new procedures and equipment on personnel was also considered. Diagrams of flow charts and program routines are given.

* See *DPD this issue, page 2* .

"Let's use more of computer potential," *by John Diebold*

AUTOMATIC CONTROL, July 1955; page 48.

Treat flow of information as a system

"Computers are not being applied as effectively as they should be.... (they) are typically being applied to mechanize segments of processes...that are now performed manually or are only partially mechanized. In very few cases is the entire flow of information being analyzed, mechanized, and treated as a system....This situation is in sharp contrast with information theory and with the design concept of the computer....The flow of sales orders, production scheduling, inventory control, and purchasing are all intimately related. A change in one process affects several and eventually all of the others. When a computer application does not take this fact into account in its basic plant, something less than optimum handling of data is bound to result."

"Automatic digital computers in industrial research," *by R. F. Clippinger, B. Dimsdale, and J. H. Lewis.*

JOURNAL OF THE SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS. Part V, September 1954.*

Small organizations can use computers profitably

An example of preparation of a payroll problem for a computing system is given in Part V, as an illustration of the use of a computer in business problems. It is pointed out that general accounting and inventory control are other areas for the profitable use of computing equipment, even for the smaller organization. In the case of the smaller organization, however, it is suggested that the high cost of an installation may be eliminated if the company is able to lease time on another organization's equipment.

Conclusions drawn are that the application of computers to business problems requires a long and detailed period of preparation; and that the group working on the preparation must combine a maximum of business management experience, data handling experience, and general computing experience.

** Parts I through IV were reviewed in DPD, June 1955; page 3.*

"IDP worked out"

PAPERWORK SIMPLIFICATION, First Quarter 1955.

Punched tape reproduces orders in decentralized plants

Flagg-Utica Corporation is working out a system of integrated data processing to send orders from its New York office to its various production plants by means of common-language tape, and to use the tape for other documents as well.

((This is similar to the Alcoa application. See DPD, June, 1955.))

"Data processing begins at home," ***by Milton Stone, ElectroData Corp., Pasadena, Calif.***

AUTOMATION, August 1955; page 48.

Requirements for data processing systems design

The systems man who is designing a data processing program must know data processing techniques and his own company operation. Furthermore, he should be able to think imaginatively, and in terms both of human relations and management. He must use data processing tools wisely and with discrimination; he must know their capabilities; and he must understand that they are more than cost-cutting tools.

"Fitting computers into a business"

BUSINESS WEEK, July 30, 1955; pages 40-44.

Computers bring new ways to business

Railroad presidents and other industrial executives tell how computers might create wholly new ways of doing business.

"Electronic Data Processing in Industry"

New book, American Management Association, 1955.

A.M.A. Conference report in book form

Special Report No. 3, a selection of the reports and papers presented at the AMA Conference in New York, February 28, March 1-2, 1955. Many of these papers have been reviewed in DPD during the past two months. Price of the Special Report No. 3 is $5.75 to AMA members, $7.75 to non-members.

Applications

"Processor handles production data"

AUTOMATION, June 1955; page 76.

Machine loading by Univac File-Computer

A suggested application of the Univac File-Computer is in machine loading and scheduling operations. "Master operations decks of punched cards could be pulled from file and reproduced for each part to be made for a specific order. These cards would be fed into the File-Computer where standard hours required are extended, and start and completion dates automatically computed. Productive time required by weeks or manufacturing periods can then be referred to the proper location in the magnetic drum storage. The machine can be programmed to signal production schedule overload condition in any given week..."

"It is not necessary to sort the cards by department or machine center. If an overload condition is indicated, all operations cards pertaining to a specific order are together, eliminating the time consuming job that must be done by present methods to find all operations cards for a specific order, and bring them together before re-scheduling."

"Electronic installation"

BEST'S INSURANCE NEWS (Fire and Casualty Edition) July 1955; page 71.

Policy owner accounting by electronics

Mutual of Omaha has installed an IBM 705 system for phases of policy-owner accounting. The machine will initially be applied to phases of premium collection and accounting, premium and claim statistics, agency statistics, rate calculations, actuarial calculations, and file maintenance. The company began its study in May 1954.

Control

"Numerical data controls milling machine"

AUTOMATIC CONTROL, July 1955; pages 20-21.

"Automatic control now harnesses complex machining"

CONTROL ENGINEERING, August 1955; pages 12-13.

Automatic control in machining

Descriptions of the Giddings & Lewis Numericord system including photographs of the machine and its control equipment.

Equipment

"A new approach to information storage," *by Gilbert W. King, International Telemeter Corporation.*

CONTROL ENGINEERING, August 1955; pages 48-53.

Information storage by photographic recording

A suggested method of storing information for digital computing operations is by photographic recording in concentric circles on a disc. This method is especially usable where information may be recorded and stored at a leisurely rate, but where access time must be very rapid. The information is read from the disc either by movement of the disc past a stationary spot of light or scanning the disc with a moving spot of light. A combination of the two gives the lowest access time.

A 16" disc with storage on the outer four inches can hold 20 million bits ((approximately 3 million characters)). At a speed of 2400 rpm, the information is read at a rate of one million bits per second. The maximum access time to an item chosen at random is the time of one revolution, or 25 milliseconds. This can be reduced by using several reading heads.

In recording, groups of information are accumulated in a temporary store (display), and proofed. Displays may be decks of light boxes which are actuated by the information source device to be illuminated or left dark according to the information bit. The resulting pattern is then photographed, either directly on the disc or on a strippable film from which the emulsion is removed and pasted on the disc. Another type of display is a printed sheet pulled from a galley of binary-coded Linotype slugs. This can be photographed and applied to the disc in a similar manner.

In an application where changes occur frequently, it is convenient to have an associated storage device of the magnetic type. When this latter device is full, its contents can be transferred to a disc by the above described process. If desired, it can be combined with information from the main disc to produce a new disc.

Examples of uses for which the photographic storage disc is especially suitable are those of a credit file where information is held for four years, and an inventory system. In the latter, the frequently changed quantities are held in an erasable medium with the constant item information retained on the disc.

"NYC to install electronic reservation system"

RAILWAY AGE, July 18, 1955; page 10.

Magnetic memory for reservations

Teleregister Corporation has designed a central reservations system (the "Centronic") for the New York Central, and will install the high-speed magnetic drum storage unit with its control equipment at the Teleregister laboratories at Stamford, Conn. Ticket agents on the NYC lines east of Buffalo will have access to the system through a small "agent's keyset" at their desks.

"Specialized electronic equipment development"

PROCEEDINGS, Systems and Procedures Association, 1955*

Standard Register Company--Kenneth P. Morse.

Microfilm printer

The article contains the following description of Standard's electronic reproducer:

"Oversimplifying the operation somewhat for the purpose of explanation, in this machine we project light through a microfilm, enlarge the image as desired, and project the light on a glass plate. The opposite side of this glass plate has been coated with certain metals that have the ability to translate the light energy into electrical energy and thus an electrical image is set upon the metallic side of the plate. Immediately in front of the metallic side of the plate is the paper upon which the image is to be formed, then the mist chamber and the high voltage electrode. As the light image appears on the glass plate and the high voltage is discharged, the mist of dye is caused to be deposited on the paper on the image area and a reproduction is formed.

"The copy paper is not presensitized in any way--and the image requires no subsequent washing, fixing, or developing--or drying. It is immediately usable. The machine supplied to the Air Force produces 8½ x 11 copies from 35 mm film at the rate of 60 per minute and at an estimated cost of 2/10¢ each."

Addressograph-Multigraph Corporation--Harry Knox.

Electronic printer

The article gives a description of the basic principles of design of the Addressograph line of electronic printers, which transcribes information directly from unit card records to business forms.

"Master cards for A-M Electronic Printer may be plain, or punched with statistical, accounting, and control codes. They are usually IBM or Rem Rand tabulating cards upon which alpha-numeric data has been typewritten or otherwise imprinted. A-M Electronic Printers scan these imaged cards and transcribe four lines of data simultaneously onto continuous mailing tapes, bill, premium notices, mail promotion pieces or other business forms at speeds on the order of 400 to 12,000 or more per hour....Data to be transcribed is typed onto the tabulating cards in lines located between the punching rows....If a part of the data to be typed is also punched, an interpreter may be used to print this information in the scan area, thus eliminating manual typing and proofing. The A-M Printer automatically feeds these image-bearing cards and photoelectrically scans information printed on them.

Light signals are generated at the scanning point, then converted to electrical impulses, then amplified to energize electromagnetic printing vibrators which reproduce facsimile images of the scanned letters and numerals onto a continuous output form."

Variations of this basic printer are described, including one being designed which can reproduce on cut rather than continuous cards. Examples of their use are mentioned, and the basic design is represented in an illustrative drawing.

* See *DPD this issue, page 2*.

"Proceedings of the Eastern Joint Computer Conference"

American Institute of Electrical Engineers, 1955.

New equipment in Proceedings

Twenty-two papers and discussions are included in the Proceedings of the Eastern Joint Computer Conference held in Philadelphia, December 8-10, 1954. Of special interest among the papers are a description of the Remington-Rand high speed printer; the new Marchant Computer System with its magnetic tape capsules; the Burroughs E101 digital computer, designed to fill a need between a desk size calculator and large-scale computer.

Copies may be obtained at $3.00 each from the Association for Computing Machinery, 2 East 63rd Street, New York 21; American Institute of Electrical Engineers, 22 West 39th Street, New York 18; or Institute of Radio Engineers, 1 East 79th Street, New York 21.

"Solenoids press buttons on punch card machine"

AUTOMATIC CONTROL, July 1955; page 30.

Automatic key punch

Monroe has equipped an accounting machine with a special adaptor to actuate a device which, when placed over the keys of any key punch, will punch out the desired information from the accounting machine onto punched cards. It can also punch tape simultaneously.

Management Decision-making Techniques

Report of the Montreal Meeting of the Econometric Society

ECONOMETRICA, July 1955; pages 324-337.

Newsprint trim, gasoline blending, by linear programming

Two papers of special interest at the Montreal Meeting in September 1954, were the following:

"The trim problem: an application of linear programming to the manufacture of newsprint paper," ***by A. E. Paull and John R. Walter, Abitibi Power and Paper Co., Ltd.***

"Abitibi manufactures rolls of newsprint paper to meet customers' specifications with regard to width and diameter. In cutting these customer rolls from larger reels of paper, trim losses are incurred. This study describes an application of linear programming methods to the reduction of the total trim loss incurred by six of our machines."

"Use of linear programming in selective blending studies,"
by J. W. Davie, Esso Standard Oil Company.

At the company's Baton Rouge Refinery, experiments in linear programming are directed toward "finding means of applying selective blending on a day-to-day basis. The major problem is that while long range linear programs are necessary to set up the optimum seasonal storage programs, the blends calculated in these studies cannot be used in blending because of day-to-day component variability."

"Operations Research for Management," ***by Joseph F. McCloskey and Florence N. Treflethen, Johns Hopkins University, New book. Johns Hopkins Press, Baltimore. $7.50.****

Basic O.R. text

Introductory text to operations research. Contains case histories and specific applications in supermarkets, promotion evaluation in sales, printing industry and agriculture.

** May be ordered through AUTOMATION.*

Training, Seminars, Meetings

"Establishing an integrated data processing system," AMA Seminar; two meetings--Sept. 29-30, Oct. 27-28, 1955. American Management Association, New York.

Manufacturing Division, American Management Association; conference on automation. Hotel Roosevelt, New York; Oct. 10-12. Members, $75.00. Non-members, $90.00. Write AMA, 330 W. 42nd St., New York 36.

Systems and Procedures Association, 8th International Systems Meeting, Oct. 10-12, 1955; Hotel Sheraton Cadillac, Detroit. General Sessions, Seminars, In-plant Seminars covering general systems and procedures subjects, electronic data processing, and operations research. For registration or further information write: Mr. George H. Rule, Methods and Planning Dept., Standard Accident Insurance Co., 640 Temple Ave., Detroit, Michigan.

Institute of Management Science National Meeting, New York, Oct. 20-22. For further information write: Gifford H. Symonds, Esso Standard Oil Company, P. O. Box 185, Linden, New Jersey.

Second Computer Clinic (along with the Second International Automation Exposition) Nov. 14-17, 1955; Chicago Navy Pier. Registration fee: $5.00. Six two-hour lecture and demonstration sessions on a choice of 12 types of computers. For information and registration write: Second International Automation Exposition, 845 Ridge Avenue, Pittsburgh 12, Pa.

"Problems of electronic applications in the office," AMA Seminar; two meetings--Nov. 28-30, 1955, Jan. 9-11, 1956. American Management Association, New York.

Engineering and Management Course, University of California at Los Angeles; Jan. 23 through Feb. 2, 1956. Includes five classes in data processing and related subjects among others. For further information write: Edward P. Coleman, Coordinator, Engineering and Management Course, College of Engineering, University of California, Los Angeles 24, Calif.

N.M.A.A. Los Angeles Chapter, and U.C.L.A. Extension Division offer a course in the yearly curriculum leading to a Certificate of Machine Accounting. For further information write: Los Angeles Chapter, National Machine Accountants Association, P. O. Box 3162, Terminal Annex, Los Angeles 54, Calif. , or Dr. Malcolm Heslip, Business Administration Extension, University of California, 813 South Hill St., Los Angeles 14 (TUcker 6123).

Controllers Institute, Nov. 7-9, 1955, Statler Hotel, Los Angeles.

"Computers in Business and Industrial Systems," Eastern Joint Computer Conference (IRE-AIEE-ACM), Nov. 7-9, 1955; Hotel Statler, Boston, Mass.

National Machine Accountants Association Electronic Business Systems Conference, Nov. 10, 11, 1955; Statler Hotel, Los Angeles. Registration fee (member and nonmember) through Sept. 22: $10.00. After Sept. 22: $15.00. For further information write: Electronic Business Systems Conference, P. O. Box 221, South Gate, Calif.

Resource Materials

Bibliographies

Management Sciences Research Project--A bibliography of twenty-six papers published by the Management Sciences Research Project at UCLA contains some titles of general interest in the application of data processing techniques. The papers are grouped under the headings, "Production Planning and Scheduling," "Data Processing," and "Work Measurement." A copy of the bibliography or any of the papers may be obtained by writing to: Dr. Fred D. Rigby, Head of Logistics Branch, Office of Naval Research, Washington 25, D. C.

Controllership Foundation -- The second in its series of references: "Electronics in Business: A Descriptive Reference Guide." This issue contains all of the items which appeared in the July 1954 issue, plus new material which appeared in the period from May 1, 1954 to May 31, 1955. The reference guide may be ordered from the Controllership Foundation, Inc., 2 Park Ave., New York 16. Price, $2.00.

Reports and Articles

"Review of Electronic Digital Computers," Proceedings of the Joint AIEE-IRE Computer Conference, December 1951. Published by American Institute of Electrical Engineers. Price $3.50.

"Review of Input and Output Equipment Used in Computing Systems," Proceedings of the Joint AIEE-IRE Computer Conference, December 1952. Published by AIEE (see above). Price $4.00.

Proceedings of the Western Computer Conference, February 1953. Published by The Institute of Radio Engineers. Price $3.50.

Proceedings of the Eastern Joint Computer Conference, December 1953. Published by IRE (see above). Price $3.00.

"Trends in Computers: Automatic Control and Data Processing," Proceedings of the Western Computer Conference, February 1954. Published by AIEE. Price $3.00.

Proceedings of the Eastern Joint Computer Conference, December 1954. Published by AIEE. Price $3.00.

"A New Approach to Office Mechanization: Integrated Data Processing through Common Language Machines," U. S. Steel Corporation Program; American Management Association Report.

Retail Stores: "Electronics...New Horizon in Retailing," by J. E. Edison and others. Aer Associates, 6450 Cecil Avenue, Clayton 5, Missouri. Price $10.00.

"Business Data Processing--A Case Study," and "A Merchandise Control System," by William L. Martin. Proceedings of Western Computer Conference, February 1954.

Production and Inventory Control: "Cost Reduction Through Electronic Production Control," by R. G. Canning. MECHANICAL ENGINEERING, November 1954.

Books

"Electronic Data Processing in Industry," American Management Association Special Report # 3. Price $7.75.

"Data Processing by Electronics," Haskins & Sells. Sent on request.

Correction: On page 4 of the August 1955 issue of DPD, reference is made to "Electronics down to earth," by John A. Higgins and Joseph S. Glickauf, Arthur Andersen & Co. HARVARD BUSINESS REVIEW. The issue should read: March-April 1954; pages 99-104.

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Comment

Review of Remington Rand Automatic Programming Techniques (with some explanatory comments)

Before a computer can work a mathematical problem or maintain a business inventory file, it is necessary that step-by-step detailed instructions be written for the computer, telling it exactly what to do to achieve the desired results. This process of procedure writing (programming) is very similar to the preparation of detailed engineering drawings that must be made of every part going into an automobile, to tell the machine tool operators just how to make the parts.

It usually requires a large number of man-hours to write these detailed computer instructions. Experience has shown that about 85% of problem preparation time has been spent on definition of the problem, problem analysis, and laying out the overall method. The remaining 15% of the time has been spent in coding the problem (writing the detailed steps), and checking out the code on the computer (debugging). [1]

Automatic programming methods are now appearing to help reduce the number of man-hours needed to prepare these programs. So far, these automatic techniques are aimed at the 15% of the time--the routine coding of the problem. The techniques do not analyze, define, or lay out methods of solution of a problem; rather, they code and debug it. The importance of this debugging should not be minimized. With a large program, involving thousands or tens of thousands of program steps, it is often impossible to do a thorough job of manually debugging the program (especially odd combinations of exceptions), so that the programmer is never really sure that his program is right. Automatic programming should greatly reduce the difficulties in this area.

Automatic programming requires standardization of procedures. In mathematical problems, this is not too difficult since the mathematical procedures are reasonably well standardized anyway. In business problems, this is not the case; methods of up-dating an inventory file will vary from company to company, depending on the nature of the business. So automatic programming techniques for business probably (1) will not be developed as rapidly as for mathematical applications, and (2) will be more limited in scope, at least for some time to come.

Two terms need definition: sub-routine and routine. A sub-routine is a detailed step-by-step procedure for accomplishing one objective--e.g. the detailed method for computing an employee's gross pay for the week. Other sub-routines would cover the other aspects of payroll--computing withholding tax, Social Security, bond and insurance deductions, etc. A routine is somewhat broader in scope, and can include several sub-routines. The term is sometimes used synonymously with "running program," which means the complete program. An example would be the complete program for handling the weekly payroll for a company, including the necessary governmental reports.

Automatic routines fall into three major classes.[1] Interpretive routines translate a machine-like pseudo-code into machine code, like the IBM 701 Speed-code and the Univac Short-code for floating decimal calculations. Compiling routines read a pseudo-code, and select desired sub-routines from a library of sub-routines, linking them together to form a running program. Generative routines, when given certain specifications, will generate a routine based around those specifications. More of the variables have to be specified than for compiling routines. A sort-generator, for instance, when given item size and position of the key, will produce a routine for performing the sorting of the items. A generative routine may be called for by a compiler routine. Interpretive routines can often be stored completely in the machine's internal memory. Compilers generally require the use of tape units for auxiliary storage.

A compiler system can consist of four basic elements: sub-routines, library, pseudo-code, and main compiler.[2] The compiler sub-routines are the standardized, detailed, step-by-step instructions (in machine language) for performing the desired operations--e.g., the detailed method of computing an employee's gross pay for the week (if this could be standardized from company to company). The library is an ordered collection of all of the standard sub-routines--e.g., all of the functions involved with the weekly payroll, inventory up-dating, report preparation, etc. (if these could be standardized). The pseudo-code is the special code that indicates which of the sub-routines is involved, and which also supplies some additional information such as a memory location or a tape unit number. The main compiler is the routine which translates the pseudo-code into the detailed computer code. It should be mentioned that the programmer can insert some of his own detailed programming during the compiling operation; the compiler is not limited to the library of previously prepared sub-routines.

A simple example may be of value in illustrating these terms. Assume that a completely general procedure for computing employees' week pay under incentive pay systems has been developed. This procedure covers all possibilities that can arise from company to company. And assume that this procedure, in turn, has been coded into computer language, and is stored as a series of sub-routines.

Now, when any particular company desires a computer program for handling its incentive payroll, all it would have to specify would be:

1. The specific parts of the master procedure that are desired (for example, only individual employee incentive procedures, not group incentive procedures).
2. The specific variables for the company (the incentive schedule--what pay rates for what production rates).
3. And perhaps an indication of the arrangement of the master records--the employees' payroll records and performance records.

This information would be specified by means of the pseudo-code. The computer would examine the pseudo-code, search for and locate the desired sub-routines (for input of data, computing pay, and preparation of paychecks), would insert the necessary variables (the incentive pay schedules), and would

link the sub-routines together to form the final running program.

It should be emphasized that the sub-routines must originally be prepared with this compiling step in mind. When this is done, a running program can be obtained simply, in a few steps, and with small chance for error, by the use of compiling techniques.

It appears that applications of automatic programs for business will occur in the following areas:

1. The arranging of source data in preparation for file up-dating (posting to and adjusting files). This includes editing, checking, sorting, selecting unit records for the file, and the detailed arrangement of data.
2. File up-dating; e.g., inventory file maintenance, parts requirements files, order file, etc. There probably will be a tendency for file maintenance procedure in various companies to become more similar, in order to utilize the available automatic programs; on the other hand, automatic programs will become more general to allow for many variations in specific requirements and still retain simplicity in programming.
3. The arrangement of data for reports (format).
4. The calculations of the more standardized reports--payroll tax reports, preparation of purchase order forms, etc.
5. The preparation of programs for mathematically defined decision-aiding processes--linear-programming, statistical studies, etc.

As an indication of experience with compilers in mathematical applications, a 4000-instruction Univac program was developed from only 435 pseudo-code instructions, and the compiling required 20 minutes on the Univac. In another case, a 1100-step program was obtained from 26 A-2 instructions in four minutes. One expert believes that the acceptance of compilers may have been delayed because the time required to produce completely correct coding just seemed too small--people would not believe the results.

(To be continued)

1. "Automatic Coding for Digital Computers," Dr. Grace Murray Hopper (Sperry Rand), a talk presented at the High Speed Computer Conference, Louisiana State University, February 16, 1955. (Reprints available from Sperry Rand.)

2. *The A-2 Compiler Instruction Manual,* Remington Rand, Inc., 1955.

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